

What's Going On?

Checking In

Minds on

A Few Prism Problems

Action!

Optimizing Cylinders

Consolidation

A Few Cylinder Problems

Learning Goal - I will learn to optimize the surface area and volume of cylinders.

Minds on

A Few Prism Problems

What are the dimensions of the square-based prism box with a volume of 1,331 cm³ and minimum surface area?

→ cube

We have volume... use volume formula!

$$\begin{aligned} V &= l \times w \times h \\ \rightarrow V &= s^3 \end{aligned}$$

$$\sqrt[3]{1331} = \sqrt[3]{5^3}$$

$$l = s$$

Each side length is 11cm.

Minds on

A Few Prism Problems

What are the dimensions of the square-based prism box with a surface area of 294 cm^2 and maximum volume?

We have surface area... use surface area formula!

$$SA = 6s^2$$

$$\frac{294}{6} = \frac{6s^2}{6}$$

$$\sqrt[2]{49} = \sqrt[2]{s^2}$$

$$7 = s$$

\therefore the cube is $7 \times 7 \times 7$

Action!

Cylinders

1. When we have a **Fixed Volume** we would want to minimize **surface area**.
2. When we have a **Fixed Surface Area** we would want to maximize **volume**.

Action!

Maximizing and Minimizing

1. A cylinder with a **Fixed Surface Area**,
has a **maximum volume** when the height is
twice the radius.
- certain amount of material*
- height = diameter*

\hookrightarrow $h = 2r$

Action!

Maximizing and Minimizing

2. A cylinder with a **Fixed Volume**, has a **minimum surface area** when the height is **twice the radius**.

least amount
of material
used.

Action!The Equations $h=2r$

What is the formula for the minimum surface area of a cylinder with a fixed volume?

$$SA = 2\pi r^2 + 2\pi rh$$

$$SA = 2\pi r^2 + 2\pi r(2r)$$

$$SA = 2\pi r^2 + 4\pi r^2$$

$$SA = 6\pi r^2$$

The surface area of an optimized cylinder.

Action!

The Equations

What is the formula for the maximum volume of a cylinder with a fixed surface area?

$$V = \pi r^2 h$$

$$V = \pi r^2 (2r)$$

$$V = 2\pi r^3$$

Volume of an optimized cylinder

Consolidation

A Few Cylinder Problems

What are the dimensions of the cylinder with maximum volume that can be made with 600 cm² of aluminium?

We have surface area... use surface area formula!

$$SA = 6\pi r^2$$

$$\frac{600}{6} = \frac{6\pi r^2}{6}$$

$$\frac{100}{\pi} = \frac{\pi r^2}{\pi}$$

$$\sqrt{31.85} = \sqrt{r^2}$$

$$r = 5.6$$

$$h = 11.2$$

Consolidation

A Few Cylinder Problems

Find SA!

What is the least amount of aluminum required to construct a can with a capacity of 500 cm^3 ?
 (volume)

We have volume... use volume formula!

$$V = 2\pi r^3$$

$$\frac{500}{2} = \frac{2\pi r^3}{2}$$

$$\frac{250}{\pi} = \frac{\pi r^3}{\pi}$$

$$\sqrt[3]{79.6} = \sqrt[3]{r^3}$$

$$r = 4.3$$

$$SA = 6\pi (4.3)^2$$

$$SA = 348.5 \text{ cm}^2$$

Consolidation

Homework

Page 508
1ad, 3, 4

Page 513
1ad, 3, 6